

Amended Claims

1. (Currently amended) A method for processing data in a statistical remultiplexer that receives a plurality of channels of encoded data, comprising the steps of:

recovering video frames from the ~~channels~~ encoded data;

storing the video frames in a lookahead buffer in order to delay ~~delaying~~ transcoding of the video frames while obtaining statistical information therefrom;

determining respective bit rate need parameters for the video frames according to the obtained statistical information thereof; and

transcoding the respective video frames in accordance with the respective bit rate need parameters following the delaying thereof.

2. (Cancelled).

3. (Original) The method of claim 1, comprising the further steps of:

storing the respective bit rate need parameters in a storage device; and

recovering the bit rate need parameters from the storage device for the respective video frames for use in transcoding thereof.

4. (Original) The method of claim 1, wherein:

the statistical information of a respective video frame that is used for determining the respective bit rate

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need parameter comprises an average quantizer scale value thereof.

5. (Original) The method of claim 1, wherein:

the statistical information of a respective video frame that is used for determining the respective bit rate need parameter comprises a number of bits therein.

6. (Original) The method of claim 1, wherein:

the statistical information of a respective video frame that is used for determining the respective bit rate need parameter comprises an average bit rate associated therewith.

7. (Original) The method of claim 1, wherein:

the statistical information of a respective video frame that is used for determining the respective bit rate need parameter comprises a number of bits in macroblocks therein.

8. (Original) The method of claim 1, wherein:

the statistical information of a respective video frame that is used for determining the respective bit rate need parameter comprises a macroblock resolution thereof.

9. (Currently amended) A statistical remultiplexer that receives a plurality of channels of encoded data, comprising:

means for recovering video frames from the ~~channels~~ encoded data;

means for storing the video frames in order to delay ~~delaying~~ transcoding of the video frames while obtaining statistical information therefrom;

means for determining respective bit rate need parameters for the video frames according to the obtained statistical information thereof; and

means for transcoding the respective video frames in accordance with the respective bit rate need parameters following the delaying thereof.

10. (Currently amended) A method for processing data in a statistical remultiplexer that receives a plurality of channels comprising encoded video frames, comprising the steps of:

updating a transcoding bit rate for at least a particular video frame a plurality of times at successive intervals as transcoding thereof progresses;

bounding the updated transcoding bit rates by at least one of minimum and maximum levels that are also updated in each of the successive intervals to provide corresponding bounded and updated transcoding bit rates; and

allocating the bounded and updated transcoding bit rates for transcoding corresponding portions of the particular video frame in the successive intervals;

computing a target frame size for the particular video frame that indicates an amount of data that is expected to result from transcoding the particular video frame;

wherein:

the target frame size is bounded by at least one of minimum and maximum predicted values that are updated in the successive intervals;

the transcoding bit rate for the particular video frame in the successive intervals is determined in accordance with the target frame size.

11. (Original) The method of claim 10, wherein:
the successive intervals are periodic.

12. (Original) The method of claim 10, wherein:
the updated transcoding bit rates are bounded by both minimum and maximum levels that are updated in each of the successive intervals to provide the corresponding bounded and updated transcoding bit rates.

13. (Currently amended) The method of claim 10, ~~comprising the further step of:~~

~~computing a target frame size for each video frame that indicates an amount of data that is expected to result from transcoding thereof;~~

wherein video frames whose associated target frame size is greater than a number of pre-transcoding bits thereof bypass transcoding.

14. (Currently amended) ~~The method of claim 10, comprising the further step of:~~ A method for processing data in a statistical remultiplexer that receives a plurality of channels comprising encoded video frames, comprising the steps of:

updating a transcoding bit rate for at least a particular video frame a plurality of times at successive intervals as transcoding thereof progresses;

bounding the updated transcoding bit rates by at least one of minimum and maximum levels that are also updated in each of the successive intervals to provide corresponding bounded and updated transcoding bit rates;

allocating the bounded and updated transcoding bit rates for transcoding corresponding portions of the particular video frame in the successive intervals; and

computing a target frame size for each video frame that indicates an amount of data that is expected to result from transcoding thereof;

wherein video frames whose associated target frame size is within a predetermined difference from a number of pre-transcoding bits thereof bypass transcoding.

15. (Original) The method of claim 10, comprising the further step of:

allocating a variable amount of transmission bandwidth for passthrough data of the plurality of channels; and

adjusting an amount of transmission bandwidth for transcoding the video frames in the plurality of channels in accordance with said allocating step.

16. (Original) The method of claim 10, wherein:

the statistical remultiplexer outputs a transport stream comprising a plurality of statistical remultiplexing groups of channels; and

respective portions of a total available transmission bandwidth are used to configure respective ones of the statistical remultiplexing groups.

17. (Original) The method of claim 10, comprising the further steps of:

delaying the updated and bounded transcoding bit rates in the successive intervals according to a delay associated with an associated transcoding engine; and

allocating transmission bit rates in accordance with the updated and bounded transcoding bit rates after the delaying thereof for transmitting the particular video frame after transcoding thereof.

18. (Original) The method of claim 17, comprising the further step of:

providing a number of packets of the particular video frame after transcoding thereof to a multiplexer for multiplexing with packets of at least one other of the channels in accordance with the allocated transmission bit rates.

19. (Currently amended) The method of claim ~~10~~ 14,
~~comprising the further step of:~~

~~computing a target frame size for the particular video frame that indicates an amount of data that is expected to result from transcoding the particular video frame;~~

wherein the transcoding bit rate for the particular video frame in the successive intervals is determined in accordance with the target frame size.

20. (Currently amended) The method of claim 19, wherein:

the target frame size is bounded by at least one of minimum and maximum predicted values that are updated in the successive intervals.

21. (Original) The method of claim 20, wherein:

the at least one of minimum and maximum values are determined in accordance with a current fullness of an associated transcoding engine buffer.

22. (Original) The method of claim 20, wherein:

the at least one of minimum and maximum values are determined so as to protect an associated decoder buffer from underflow or overflow.

23. (Original) The method of claim 19, comprising the further step of:

estimating a time for transmitting at least one packet comprising transcoded data of the particular video frame according to the target frame size.

24. (Currently amended) ~~The method of claim 19, comprising the further step of:~~ A method for processing data in a statistical remultiplexer that receives a plurality of channels comprising encoded video frames, comprising the steps of:

updating a transcoding bit rate for at least a particular video frame a plurality of times at successive intervals as transcoding thereof progresses;

bounding the updated transcoding bit rates by at least one of minimum and maximum levels that are also updated in each of the successive intervals to provide corresponding bounded and updated transcoding bit rates;

allocating the bounded and updated transcoding bit rates for transcoding corresponding portions of the particular video frame in the successive intervals;

computing a target frame size for the particular video frame that indicates an amount of data that is expected to result from transcoding the particular video frame; and

estimating a time for inserting clock reference data into at least one packet comprising transcoded data of the particular video frame according to the target frame size;

wherein the transcoding bit rate for the particular video frame in the successive intervals is determined in accordance with the target frame size.

25. (Currently amended) The method of claim ~~19~~ 24, wherein:

the target frame size is bounded by at least one of minimum and maximum values that are updated in the successive intervals.

26. (Currently amended) A statistical remultiplexer that receives a plurality of channels comprising encoded video frames, comprising:

means for updating a transcoding bit rate for at least a particular video frame a plurality of times at successive intervals as transcoding thereof progresses;

means for bounding the updated transcoding bit rates by at least one of minimum and maximum levels that are also updated in each of the successive intervals to provide corresponding bounded and updated transcoding bit rates; and

means for allocating the bounded and updated transcoding bit rates for transcoding corresponding

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portions of the particular video frame in the successive intervals;

means for computing a target frame size for the particular video frame that indicates an amount of data that is expected to result from transcoding the particular video frame; wherein:

the target frame size is bounded by at least one of minimum and maximum predicted values that are updated in the successive intervals;

the transcoding bit rate for the particular video frame in the successive intervals is determined in accordance with the target frame size.

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27. (Currently amended) A method for processing data in a statistical remultiplexer that receives a plurality of channels comprising encoded video frames, including a particular video frame that comprises a plurality of macroblocks in associated portions of the particular video frame, each macroblock having an associated old quantization scale when the particular video frame is input to the statistical multiplexer, comprising the steps of:

computing a target amount of data that is expected to result from transcoding the particular video frame; and

determining new quantization scales for use in transcoding corresponding macroblocks in a first portion of the particular video frame in accordance with (a) the corresponding old quantization scales, and a ratio of (b) a pre-transcoding amount of data in the particular video frame to (c) the target amount of data.

28. (Original) The method of claim 27, comprising the further step of:

rounding the new quantizer scales to an integer value.

29. (Original) The method of claim 27, wherein:

the portions comprise respective slices of the particular video frame.

30. (Original) The method of claim 27, wherein:

the new quantizer scales are adjusted, if necessary, to be no finer than the corresponding old quantizer scales.

31. (Original) The method of claim 27, wherein:

the new quantizer scales are adjusted, if necessary, to ensure that the corresponding macroblocks receive a minimum number of bits for transcoding thereof.

32. (Original) The method of claim 27, comprising the further step of:

determining new quantization scales for use in transcoding macroblocks in a second portion of the particular video frame in accordance with (a) the corresponding old quantization scales, and a ratio of (b) a pre-transcoding amount of data in remaining portions of the particular video frame to (c) a target amount of data that is expected to result from transcoding the remaining portions.

33. (Original) The method of claim 32, wherein:

the target amount of data that is expected to result from transcoding the remaining portions is determined by

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decrementing the target amount of data that is expected to result from transcoding the particular video frame by an amount of data generated in transcoding the first portion.

34. (Original) The method of claim 32, wherein:

the pre-transcoding amount of data in the remaining portions is determined by decrementing the pre-transcoding amount of data in the particular video frame by a pre-transcoding amount of data in the first portion.

35. (Original) The method of claim 27, comprising the further step of:

maintaining a running count of an amount of data used in transcoding the portions;

wherein, if the running count exceeds a maximum level, a panic quantization scale is set until there are enough bits left for the macroblocks in the remaining portions to receive a minimum number of bits for transcoding thereof.

36. (Original) The method of claim 35, wherein:

the maximum level is adjusted downwards after transcoding of each portion.

37. (Original) The method of claim 27, wherein:

each macroblock has its own associated old quantization scale.

38. (Original) The method of claim 27, wherein:

a group of the macroblocks has its own associated old quantization scale.

39. (Currently amended) A statistical remultiplexer that receives a plurality of channels comprising encoded video frames, including a particular video frame that comprises a plurality of macroblocks in associated portions of the particular video frame, each macroblock having an associated old quantization scale when the particular video frame is input to the statistical multiplexer, comprising:

means for computing a target amount of data that is expected to result from transcoding the particular video frame; and

means for determining new quantization scales for use in transcoding corresponding macroblocks in a first portion of the particular video frame in accordance with (a) the corresponding old quantization scales, and a ratio of (b) a pre-transcoding amount of data in the particular video frame to (c) the target amount of data.

40. (New) A statistical remultiplexer that receives a plurality of channels comprising encoded video frames, comprising:

means for updating a transcoding bit rate for at least a particular video frame a plurality of times at successive intervals as transcoding thereof progresses;

means for bounding the updated transcoding bit rates by at least one of minimum and maximum levels that are also updated in each of the successive intervals to provide corresponding bounded and updated transcoding bit rates;

means for allocating the bounded and updated transcoding bit rates for transcoding corresponding portions of the particular video frame in the successive intervals; and

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means for computing a target frame size for each video frame that indicates an amount of data that is expected to result from transcoding thereof;

wherein video frames whose associated target frame size is within a predetermined difference from a number of pre-transcoding bits thereof bypass transcoding.

41. (New) A statistical remultiplexer that receives a plurality of channels comprising encoded video frames, comprising:

means for updating a transcoding bit rate for at least a particular video frame a plurality of times at successive intervals as transcoding thereof progresses;

means for bounding the updated transcoding bit rates by at least one of minimum and maximum levels that are also updated in each of the successive intervals to provide corresponding bounded and updated transcoding bit rates;

means for allocating the bounded and updated transcoding bit rates for transcoding corresponding portions of the particular video frame in the successive intervals

means for computing a target frame size for the particular video frame that indicates an amount of data that is expected to result from transcoding the particular video frame; and

means for estimating a time for inserting clock reference data into at least one packet comprising transcoded data of the particular video frame according to the target frame size;

wherein the transcoding bit rate for the particular video frame in the successive intervals is determined in

accordance with the target frame size.

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